NO. 23.

THE Sidereal Messenger.

Conducted by Wm. W. PAYNE,
Director of Carleton College Observatory.

APRIL, 1884.

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"He telleth the number of the stars; He calleth them all by their names."

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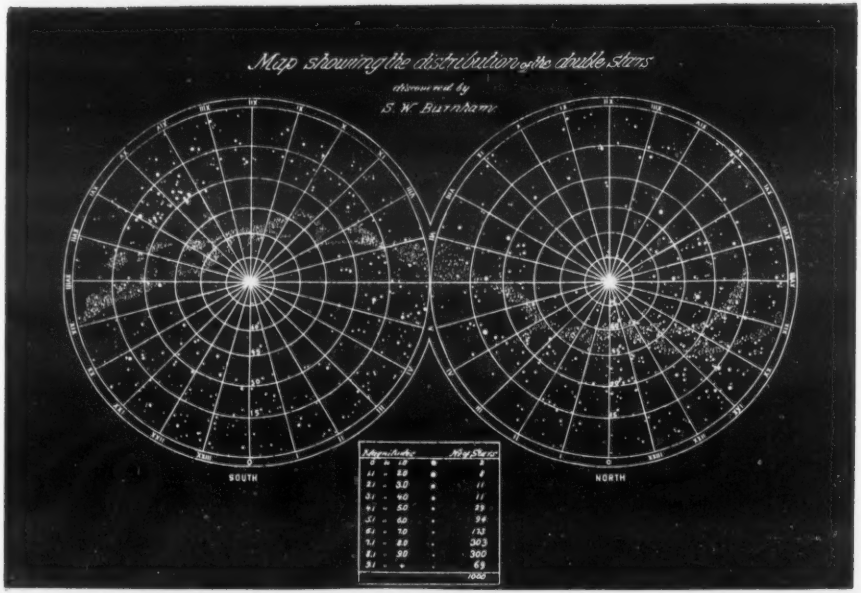

Map showing the distribution of the double stars
discovered by
S. W. Burnham.
SOUTH
NORTH
Magnitudes
May Stars
1880

XUM

The Sidereal Messenger.

Conducted by Wm. W. PAYNE, Director of Carleton College Observatory.
Northfield, Minn.

"In the present small treatise I set forth some matters of interest to all observers of natural phenomena to look at and consider."—GALILEO, *Sidereus Nuncius*, 1610.

VOL. 3. NO. 3. APRIL, 1884. WHOLE NO. 23.

Mr. S. W. BURNHAM, *Micrometrical Measures of* 748 *Double-Stars made with the* 18½*-inch Refractor of Dearborn Observatory.**

The diagram given on the opposite page was prepared in the first instance for my own information, concerning the distribution in space of the new double-stars contained in this and the preceding catalogues. It then seemed that a reproduction of it might properly find a place at the close of the series. These double-stars are as uniformly scattered over the surface of the sky as could be expected when due allowance is made for the unequal distribution of stars generally, and the difference in observing weather at different seasons of the year. The Milky Way, of course, furnishes a greater number of new double-stars than the same area elsewhere; and that part of the heavens on the Meridian in the fall and summer months was more carefully examined, and with correspondingly better results.

No systematic search has been made for the discovery of new pairs. At this time, when comparatively so little has been done in the detection of really difficult objects, it is hardly worth while taking the necessary time to follow any special plan in looking for new pairs. No appreciable amount of time can be lost by the repeated examination of

Extract from the appendix of Mr. Burnham's fourteenth catalogue of double-stars, recently published by the Royal Astronomical Society of England.

stars when the telescope is directed at random. A hundred years hence it may be desirable to make a careful systematic study of all the stars, not known to be double, down to the eleventh or twelfth magnitude, with the great refractors of that time, and especially if some location shall be found where a steady air and good definition can be had most of the time, at certain seasons of the year at least. Under such circumstances a thorough examination by an experienced observer of stars not catalogued as double would lead to valuable results, and would practically exhaust the field of discovery so far as the moderate or smaller apertures used in observatories now established are concerned. The Southern Hemisphere, however, is an almost untried field, particularly that portion within 40° of the South Pole. Very few close pairs have been discovered, and in the region mentioned there is probably not one double-star known that would be called difficult with the telescope of this observatory. Assuming a uniform distribution of double-stars in the Northern and Southern Hemispheres, several hundred fairly close pairs could be picked up with a small aperture of first-class definition without going below the eighth magnitude. A large number of close and unequal pairs will be found in the naked-eye stars.

The whole number of stars represented in the accompanying map is 1,000, of the following orders of brightness:—

Magnitudes.	No. of Stars.	Magnitudes.	No. of Stars.
0 to 1.0	2	5.1 to 6.0	94
1.1 " 2.0	8	6.1 " 7.0	173
2.1 " 3.0	11	7.1 " 8.0	303
3.1 " 4.0	11	8.1 " 9.0	300
4.1 " 5.0	29	9.1 " +	69
Total	...	..	1000

LIMITING DISTANCE OF NEW PAIRS.

My catalogues, particularly the earlier ones, contain a few stars which, from the distance of the components, it would

have been better to reject. It may sometimes be desirable to record faint companions to bright stars and previously known pairs when they are beyond the ordinary limits of distance, but it is rare that the maximum distance of the Pulkowa Catalogue, 16″, should be exceeded, and in stars from 8 or 8.5 magnitude down, the companion should generally be within 5″ at the most. Pairs of this distance will rarely prove of much interest. All the rapid and interesting binaries are much closer.

Omitting some of the wider pairs, and also the close pairs which have not been measured, there are left 743 double-stars out of 1,000 which are represented by the following mean distances:—

Magnitude.	No. of Stars.	Mean Distances.
3.1 to 4.0	6	1.88
4.1 " 5.0	16	1.89
5.1 " 6.0	61	1.80
6.1 " 7.0	119	1.92
7.1 " 8.0	240	1.36
8.1 " 9.0	247	1.57
9.1 " +	54	1.63
Mean distance of 743 stars =		1.58

In the early history of double-star astronomy, when for this work instruments were inferior as well as smaller, there might have been some excuse for including in a catalogue wide pairs, and those where both components were faint; but at this time there is no justification for ever calling two tenth-magnitude stars which happen to be 5″ or 10″ apart a double-star in the proper sense of the term. At any time since the publication of the work of STRUVE the time spent in observing such objects would be little less than lost, and this will necessarily be the case for all time to come. Of course it is very easy to make with a telescope very moderate in size and indifferent in definition, an imposing catalogue of so-called discoveries, so far as numbers go, if these

XUM

faint and wide couples are included; but the value of such a list now and in the future will depend solely upon the number of first-class pairs it contains. The Pulkowa Catalogue, as given in Vol. IX of the publications of that observatory, will serve as a model for this class of work so far as the element of distance is concerned. A close pair—that is, where the distance does does not exceed 1″—should be recorded, however faint the components may be, and of course the magnitude of the companion to any star should have no weight in retaining or measuring it as a double-star.

An examination of the various double-star catalogues of original entry with reference to the proportion of close pairs is instructive as illustrating the relative number of systems of this kind in each, as well as showing the greater perfection of modern telescopes for this kind of work. Those of the STRUVES are so well known that further comment is unnecessary.

The seven catalogues of Sir JOHN HERSCHEL contain nine stars where the estimated distance is 1″ or less. Of this number I have examined and measured seven, the distances being 2″.5; 1″.81 ("violent suspicion," H.); 1″.02 ("almost certain," H.); 2″.27; 3″.26; 1″.2 ("not verified," H.); and 1″.80. The remaining two could not be found, one being noted as doubtful by HERSCHEL. So that at most we have only two pairs of Class I. HERSCHEL gives 68 stars of Class II, estimated at 1½″ to 2″, all of which, with perhaps three or four exceptions, are below the ordinary limits of magnitude, most of them being from 10 to 12 magnitude. In all, about 24 of these stars have recently been observed, mostly at Cincinnati and Chicago, of which 16 exceed 2″ in distance, and four were not found as described, four pairs only coming within the limits of Class II. It is practically certain that of the remaining 44 stars there would not be more than a dozen that would come within the required distance. I have assumed the number, however, to be 20.

The following table gives all the principal original double-

star catalogues published, and the number of pairs in each of Class I (distance from 0″ to 1″) and Class II (distance from 1″ to 2″). In the last column is given the ratio of stars of these classes to each thousand double-stars catalogued by the discoverer:—

	Class I.	Class II.	Total.	Ratio.
BURNHAM, Catalogue of 1,000 stars	266	254	520	520:1000
O. STRUVE, " " 547 "	154	63	217	400:1000
STRUVE " "2,640 "	91	314	405	150:1000
HERSCHEL I " " 812 "	12	24	36	45:1000
HERSCHEL II " "3,429 "	2	20	22	7:1000
ALVAN G. CLARK	14	1	15	
All other observers	40	75	129	
			1344	

From this investigation we find the pairs having a distance not exceeding 2″ are less than 1,400; and it is safe to say that the total number of stars now known which can be properly called double is but little if any greater than 3,000, and that at least three-fourths of the remainder are not worth observing for any reason.

THE SATELLITES OF MARS.

BY THE EDITOR.

Aside from the books written by Professors NEWCOMB and HOLDEN, and the paper by Professor HALL, very little has been published concerning the satellites of *Mars*. Though several years have passed since the discovery of these small bodies, scarcely anything new can now be added that will interest the student of astronomy, or the general reader who has access to these valuable books and paper above mentioned. Although this be true, it seems desirable, from the queries of recent correspondents, to make a re-statement of what is known of the satellites of *Mars* for

the convenience of readers who may not have the information at hand.

This notable discovery was made August 11–17, 1877, by Professor ASAPH HALL of the Naval Observatory, Washington, D. C. It was not accidental, for Professor HALL began the study of the subject in the spring of that year, examining all authorities within reach, and when the time of opposition came a systematic search with the great equatorial was undertaken, and prosecuted through discouraging circumstances until the two moons were found, and until it was settled that there were two and not three, as at one time supposed, on account of the rapid motion of the inner one.

It is impossible to convey, in words, the impression that this discovery made on the minds of leading astronomers everywhere. It was justly esteemed a triumph of patience and skill of high order, to which will be given appropriate place in the history of modern astronomy.

Of the many names suggested for the satellites of *Mars*, Professor HALL chose those suggested by Mr. MADAN of Eaton, England, viz.:

For the outer satellite, Deimos.

For the inner satellite, Phobos.

The classical scholar will remember that these are the names which Homer applies to the horses which drew the chariot of *Mars*, and that the passage, as translated by Bryant, reads:

> "He spoke and summoned Fear and Flight to yoke
> His steeds, and put his glorious armor on."

The time chosen for the search was very favorable on account of the relative positions of *Mars* and the *Earth*. This happens when *Mars* is as near the *Sun* as possible, and the *Earth* as far away as possible, and *Mars* opposite from the *Sun*, and can occur only once in fifteen years.

In 1877 these conditions were nearly fulfilled, and the planet *Mars* was, at nearest approach, about 36 millions of miles from the *Earth*. The *Sun* was in apogee July 3, and *Mars* was in perigee August 21, and opposition occurred

September 5. If these phases of the planets had taken place nearer the same date the distance between them would have been less, and by so much, observation more favorable.

These satellites are the smallest celestial bodies known. In the largest telescopes they appear as points of light, and hence can not be measured at all in the ordinary way. The inner satellite is a little brighter than the other, and, therefore, possibly a little larger. Their diameters are probably less than ten miles, and are assumed to be about six and seven miles respectively.

The outer satellite, Deimos, revolves around the planet in $30^h\ 16^m$, and the inner one, Phobos, in $7^h\ 38^m$. The latter is 5,800 miles from the center of *Mars*, and less than 4,000 miles from its surface. It would, therefore, be quite possible with one of our telescopes on *Mars* to know if the inner satellite is inhabited, for the motion of living beings could be easily recognized.

With these facts before the mind, it is impossible to realize the problem of difficult seeing that was mastered by the aid of the telescope, in observing these minute bodies at the distance of 36 millions. The outer satellite was seen at a distance of about 6 or 7 million times its own diameter; as Professor HOLDEN has aptly said, it is like suspending a ball two inches in diameter and viewing it with a telescope at a distance equal to that between Boston and New York. "Such a feat of telescopic seeing is well fitted to give an idea of the power of modern optical instruments."

The rotation-time of the planet *Mars* is $24^h\ 37^m$. As before said, the time of revolution of Phobos is $7^h\ 38^m$, so that the satellite evidently would revolve more than three times about the primary while it was making but a single rotation on its axis. To an observer on *Mars* this curious relation of the two motions would cause most interesting physical phenomena, some of which may be briefly noted here. It will be remembered that the motion of the planets around the *Sun*, and all the satellites, with two exceptions, around their primaries, are in the same direction, and that

is from west to east. This is also true of the rotation of the planets on their axes so far as known. Now, if this be so, the apparent diurnal motion of a satellite in the heavens will be approximately the difference of the two motions. If the planet rotates on its axis more rapidly than the satellite revolves about the common center of gravity, then the satellite will appear to rise in the east and set in the west. This is constantly observed in the case of the *Moon;* also in Deimos, whose revolution-period is $30^h\ 16^m$. But this satellite's motion is a little slower than that of the planet, and so there would be a slow westward apparent diurnal motion that would be very strange to people like ourselves. On the other hand, because of the rapid motion of Phobos, it would appear to rise in the west and set in the east, and because the relative motions of planet and satellite are greatly different, the apparent diurnal motion of this satellite would be as surprisingly rapid to an observer on *Mars* as that of Deimos was slow. The phenomenon of two satellites rising at the same time—for example, one in the east and the other in the west—and the latter sweeping through the sky eastward, at the rate of about 45° per hour, and, in less than four hours, meeting the other a few degrees above the eastern horizon on its slow westward march, would be a view at first sight almost as impressive as MITCHEL's first sunset in Adam's time. Add to this the supposition that the planet *Mars* is inhabited by beings not greatly unlike ourselves, with telescopes or some other means of aiding the natural powers of sight equal or superior to those we enjoy, and the field of speculation is limitless and interesting to those possessing a lively imagination.

The Misses. Lassell, last year, kindly placed a 7-foot Newtonian telescope at the disposal of Professor WILLIAM HUGGINS of England, to aid in photographing the solar corona. Between April 2 and September 4, fifty photographs were taken all of which show a coronal appearance. The coronal appearance in some of these pictures has been proved genuine as far as 8′ from the *Sun*, (216,000 miles).

ON THE DEFLECTION OF THE LEVEL DUE TO SOLAR AND LUNAR ATTRACTION*.

BY F. G. HAGEN S. J. COLLEGE OF THE SACRED HEART, PRAIRIE DU CHIEN, WIS.

The deflections of the Vertical have been experimentally studied by de Rossi, Plantamour and Zollner, but during the last decennium this question became of greater interest by the publications of Mr. d'Abbadie: "Etudes sur la Verticale," 1872, and "Recherches sur la Verticale," 1881, etc., which are not yet complete and are to embody his observations made in Brazil, Ethiopia and in the south of France since almost half a century; and also by the two reports of the committee appointed by the Brittish Association for the measurement of the lunar disturbance of gravity, which were published in 1881 and 1882. Whilst these publications show forth results that cannot be fully explained as yet, it is strange to say that even the theoretical part of the question seems to be unsettled with many authors. We will give some of their results in historical order, but, to avoid confusion, reduce them to a common notation as follows: Let m be the mass of the disturbing body, r and r' its distances from the center of the *Earth* and from the level, z and z' its zenith distances as seen from the center of the *Earth* and from the level, M and ρ the mass and radius of the *Earth* respectively, and h the horizontal parallax of the *Moon* in seconds of arc.

1824. N. H. Abel, in the "Magazin for naturvidenskaberne" 8, Christiania, 1. serie, t. III, p. 219.

$$\text{Lunar Deflection} = \left\{ \frac{m}{r^2} \sin z : \frac{M}{\rho^2} \right\} 206264.''67$$

Substituting $m = M : 68.5$ and $\rho : r = 0.01655101$ he obtains $0''.825 \sin z$.

1844. C. A. F. Peters, "Von den Kleinen Ablenkungen der Lothlinie etc." in Bulletin de l'Academie Imp. de St. Petersbourg, t. III, No. 62, p. 212.

*A. N. No. 2568.

$$\text{Deflection} = \left\{ \frac{m}{r'^2} \sin z' - \frac{m}{r^2} \sin z \right\} : \frac{M}{\rho^3}$$

$$= \frac{3}{2} \frac{m}{M} h^3 \sin 2z \, (\sin 1'')^2$$

Substituting $M : m = 81.24$, $h =$ p. 57′ he obtains for the *Moon* $= 0''.0174\, \rho^3 \sin 2z$; and in the case of the *Sun* $m : M = 359551$, $h = 8'.58$.

$$\text{Deflection} = 0''.0080 \sin 2z.$$

1847. C. Ramus, "Om uligheder i pendulsvingningerne formedelst et himmellegems tiltraekning" in the "Oversigt over det Danske videnskabernes Selskabs forhanlinger, Kjobenhavn, p. 9. He gives exactly Peters' formula, and by substituting $m : M = 1 : 75$, $\rho : r = 1 : 60$, he finds

the lunar deflection $= 0''.019 \sin 2z$.

1864. E. Sang, "On the deflection of the Plummet due to solar and lunar Attractions," Edinburgh Tra. XXIII, 89. He gives the formula:

$$\text{Deflection} = \frac{1}{r^2} \times \frac{\rho}{r} \sin 2z$$

Then he continues: "For the *Earth's* mean distance (from the *Sun*) r^2 may be taken to represent 128″, and therefore (since $\rho : r = 1 : 23800$) the deflection of the plummet due to the *Sun's* attraction may be stated as $\frac{1''}{186} \sin 2z$. The *Moon*, though much nearer to us than the *Sun*, is yet so small in comparison, that the effect of a pressure equal to her attraction would only derange the plummet through one second (*i. e.* $: r^{-2}$ represents $1''$). In this case, however, the ratio of r to ρ is only 60: 1, and therefore the deflection due to the *Moon's* influence is $\frac{1''}{60} \sin 2z$ or three times that due to the *Sun*."

1876. R. v. Sterneck, "Ueber den Einfluss des Mondes etc." in the Sitzungsberichte der k. Akademie der Wissenschaften. Wien, LXXIII, 4, p. 553. He

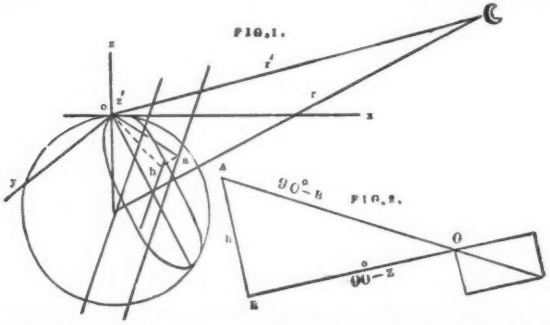
finds a lunar deflection as large as 0″.48, the direction of which is altogether independent of the *Moon's* position; his formula will be explained below.

1881. Report of the Committee appointed by the British Association. In a note to page 21 it is said, that for Cambridge the maximum meridional horizontal component of gravitation, as due to the lunar attraction, is 4.12×10^{-8} of pure gravity, and that this force will produce a deflection of the plumb-line of 0″.0085 and further that the maximum deflection of the plumb-line occurs when the *Moon's* hour-angle is $\pm45°$ and $\pm135°$ at the place of observation.

Now in order to show how far these authors do or do not agree, and upon what hypotheses they have based their calculations, we propose to solve the problem in the following way. We disregard with them the flatness and daily rotation of the *Earth*, the latter causing a constant deflection of the level, the variations of which are the very point in question; but with R. v. Sterneck we shall first suppose our *Earth* to present continually the same face to the disturbing body, thus attributing to the former a (monthly or yearly) rotation around an axis perpendicular to the orbit of the latter and passing through their common center of gravity. The mechanical effect of this supposed rotation, or of its centrifugal force, will then be equivalent to the attraction of the *Earth's* center by the *Moon* or *Sun*, but with a negative sign; and to an imaginary rotation of the *Earth* around a central axis which is parallel to the one mentioned before. By subtracting the effect of the latter from the total variation thus found, we shall have the true variation of the level.

Our system of co-ordinates is represented in Fig. 1. Let the axes of x and z be in the vertical plane that may be passed through the place of observation and the center of the disturbing body, z being directed toward the zenith and x

parallel to the horizon towards the azimuth of the luminary; the positive direction of y we shall decide below. There will be no danger of confounding the axis of z with the zenith-distance z.



The forces acting upon any particle on the *Earth*'s surface, according to our hypothesis, are: (1) the gravity g towards the center of the *Earth*; (2) the gravity γ towards the disturbing body with the two components $\gamma \sin z'$ parallel to x, and $\gamma \cos z'$ parallel to the axis of z; (3) the centrifugal force caused by the (supposed) rotation of the *Earth* and the disturbing body around their common center of gravity. Let e denote the distance of the latter from the center of the *Earth*, θ the angular velocity of this rotation, R the distance of the place of observation o from the line r joining the centers of the two celestial bodies, and λ the angle between R and the axis of rotation. Through the place of observation we pass a plane perpendicular to r, which will intersect the *Earth* in a circle; through its center and parallel to the axis of rotation we draw a diameter which will be inclined towards R by the angle λ. Now we will consider the axis of y negative on that side towards which the angle λ extends, as viewed from the place of observation. If we then draw perpendiculars from o to the axis of rotation and its parallel, the distance oa of the place of observation from the axis will have the perpendicular components

$$\rho \cos z - e \text{ and } R \sin \gamma = \rho \sin z \sin \lambda.$$

The first, being parallel to r and hence to the plane (x, z), is again resolved into $(\rho \cos z - e) \sin z$ parallel to x, and $(\rho \cos z - e) \cos z$ perpendicular to the horizon.

The other component is first resolved into $\rho \sin z \sin \lambda^2$, parallel to R, and $\rho \sin z \sin \lambda \cos \lambda$, and parallel to y; whilst the former is again resolved into $-\rho \sin z \sin \lambda^2 \cos z$ parallel to x, and $+\rho \sin z \sin \lambda^2 \sin z$, perpendicular to the horizon. Since the centrifugal force in any distance d from the axis of rotation is expressed, by $\theta^2 d$, we find the following forces acting upon the unit of mass on the *Earth's* surface.

$$X = \gamma \sin z' + \theta^2 \rho \left\{ \cos z \cos \lambda^2 - \frac{e}{\rho} \right\} \sin z$$

$$Y = + \theta^2 \rho \sin z \sin \lambda \cos \lambda$$

$$Z = -g + \gamma \cos z' + \theta^2 \rho \left\{ 1 - \sin z^2 \cos \lambda^2 - \frac{e}{\rho} \cos z \right\}$$

The equation of the level is then, in each point of the *Earth's* surface,

$$Xx + Yy + Zz = \text{const.};$$

and its deflections

$$\frac{dz}{dx} = -X : Z,$$

in the azimuth of the disturbing body, and

$$\frac{dz}{dy} = -Y : Z,$$

90 degrees distant.

(*To be continued.*)

POLARIZATION OF THE LIGHT OF THE ASTEROIDS.

BY M. W. HARRINGTON.

This account should perhaps be entitled absence of polarization in the light of the asteroids for the results obtained were negative. It had occurred to the writer that there might possibly be enough polarization in the light of these bodies to enable one to distinguish them from stars

when a sufficiently delicate apparatus was employed. They never occupy such a position that the solar light reflected from them and reaching the *Earth* leaves them at the angle most favorable for polarization; but as there is some polarization at all angles it remained to be seen whether there would not be enough in the case of the asteroids to be detected.

To test the matter I had a plate of Iceland spar made with sufficient thickness to separate the two images by about 12″. With it in the principal focus of the telescope, stellar bodies showed two distinct images entirely clear from each other and the two disks of *Mars* overlapped only slightly. This plate was placed on my wedge-photometer in such a way that in the telescope it was directed toward the objective while the wedge was on the eye-side. When placed in the telescope and focused, the two images of the body would gradually pass into the darker parts of the wedge and the test lay in ascertaining if the two images were extinguished simultaneously or one after the other. If the latter were the case the light was somewhat polarized, if the former, there was no distinguishable polarization. The images were usually in a line parallel to the diurnal motion though other directions were frequently tested.

The apparatus showed distinct polarization for the *Moon* at its quarters, and gave results in substantial accord with those obtained by other observers with different apparatus. I was satisfied, therefore, that any lack of results for the asteroids would not be due to the instrument. It was then tried repeatedly on the asteroids, but entirely without signs of polarization. There were tested in all some fifteen asteroids, which ranged in brightness all the way from *Vesta* to the twelfth magnitude, and in position all the way from opposition to as near the *Sun* as they could be picked up. I accompanied the tests with the wedge with eye-estimates of the brightness of the images, but I could in no case satisfy myself that there was a difference between them. It may be remarked that as the images were close to

gether they were in a favorable position for eye-estimates. As a result the writer believes that in no position where they can be observed is the light of the asteroids sufficiently polarized to make a difference of a tenth of a magnitude in the brightness of the images.

The apparatus was also recently tried on some of the planets. *Mars*, *Jupiter* and two of his satellites, *Saturn* and *Titan* were tried but with negative results. The planets were not far from opposition and I did not expect results from them, but I hoped for something definite in the case of the satellites. The hope, however, proved futile.

ANN ARBOR, Feb. 28th, 1884.

OBSERVATIONS ON THE PONS-BROOKS' COMET.

W. H. NUMSEN, BALTIMORE.

The following is an abstract of the result of my observations upon this comet. Whether the notes are of value, I know not, but possibly they may be of interest to some of your readers.

Only a few short and irregular observations were made in Sept., and no notes were kept, as the comet appeared for the most part as a faint and indefinite patch of light. On the 22nd, 23d and 24th, it was not observed, but on the 25th, it was, and I was surprised at its marked increase in brilliancy since previously seen; but visitors being present unfortunately no notes were made. It was next observed on Oct. 2, and from that date until Jan. 20, (when the comet was last seen by me) notes were regularly kept upon every occasion.

During Oct. the weather was generally very unfavorable, and only the 2nd, 8th, 9th, 11th, 27th and 30th were entered in my observing-book. In Nov. only one observation was secured, on the 30th. On Dec. 3d I set to work in earnest, and from that time until Jan. 29th the comet was observed upon every clear night with perhaps four or five exceptions.

XUM

The following are the dates:—Dec. 3, 6, 10, 11, 15, 16, 17, 18, 21, 25, 27, 28, 29; Jan. 2, 3, 5, 6, 9, 13, 17, 20, 21, 23, 25, 26 and 29. On the 30th and 31st it was cloudy, and after that I paid no more attention to the comet as it was too low down and set too early for me.

The dates below are selected from my observing-book, and the notes condensed from same. All the observations were made with my 4-inch Equatorial by T. Cook & Sons of York, E., and with a comet eye-piece p. 25, unless otherwise mentioned. Finder 1¼-inch. Field of view of finder 3°, of comet eye-piece 1¼°, 75th meridian time is used.

Oct. 2nd.—7:45 to 8:30 very clear, slight wind. Found with p. 25 by means of Schulhof's ephemeris. Appears as an irregular patch of faint light, without trace of nucleus or tail. Think I get a glimpse of it through finder. While making notes, it had moved out of field, (clock-work being detached), tried and succeeded in picking it up with finder.

Oct. 9th.—8 to 8:30. Very clear and beautiful. Moon just passed 1st quarter. Set by ephemeris, and comet was in field, near middle. No doubt about seeing it, while it is not easy, it is not difficult. No tail, however, and no nucleus evident. Unclamped R. A., closed eyes, and put out of field for an unknown distance, swept back and with p. 25, picked up as soon as it entered the field again. Invisible in finder.

Oct. 30th.—8:15 to 9:05. Beautifully clear, stars glistening. Brisk wind. Found at once. Undoubted condensation here now. No tail yet apparent, but nebulous matter seems larger. Pretty easy in finder.

Nov. 30th.—7:25 to 8. Pretty clear; some haze along horizon. Set telescope and found with finder; no mistake. Strong condensation now towards center, and much brighter. Fancy at times traces of a tail in *n. f.* direction, but am not positive about it.

Dec. 6th.—6:10 to 6:35. Very clear and bright. Moon near 1st qr. Swept with finder without resorting to circles, and easily caught. With p. 25 suspect streak of tail about

25′ long, *n. f.* more *n.* Not seen steadily. Getting misty. Wind from east.

Dec. 15th.—7:15 to 7:30. Clear; wind lulling. Moon just up. After sighting over telescope, could see a starry point, but nothing nebulous. Not certain whether it is the comet or not. With p. 25 not positive of tail, though possibly an elongation toward *n. f.* Nucleus, however, seems more positive.

Dec. 16th.—7:45 to 8. Pretty clear now; cloudy all day. Can see the stellar point again, but no nebulosity. If no 5th magnitude star in that position, then it is the comet. Through finder traces of a tail at once seen, and with p. 25 tail is evident; no doubt about it; plain as anything. Fully 30′ long and perhaps slightly over; fades away gradually. About 10′ from head pretty bright, balance fainter and fainter. Moon behind clouds.

Dec. 17.—6 to 6:30. Pretty clear; some haze along west. Certainly seen with naked eye now. Set finder for naked eye object and it was the comet. As easy as either of the two stars b^2 and b^3 *Cygni* upon Heis' Atlas. Tail very easy through finder, and with p. 25 certainly 35′. A regular star-like nucleus now.

From this date naked eye estimates of its brightness were made at each observation, but I shall give only the telescopic observations, except an occasional naked eye remark.

Dec. 21st.—5:35 to 6:30. Fairly clear, few clouds along west. At 5:45 easily picked up with finder, and at 6^h easily visible to naked eye. With p. 25 can't certainly trace tail more than 1°, about 40′ to 50′ pretty bright, and then fades away insensibly.

Dec. 27th.—6:25 to 6:55. Cleared up now and windy. Not the ghost of a tail to naked eye. With p. 25 can't for the life of me see any great increase in length of tail, and about 1½° is the extreme length to me. A distinct star-like nucleus now evident at once. No nebulosity except the coma. Wind increasing; afraid of roof.

XUM

Dec. 28th.—6:25 to 7:10. Very clear. Some puffs of wind at times, but generally quiet. Looks hazy to naked eye. One or twice I thought I could detect trace of tail to naked eye, but not steadily. Through finder think I can trace tail clear across field 3°, and with p. 25 it is plain to 1½° and then gradually fades away to 3° or so. Nucleus at first did not strike me as stellar, though afterwards thought it was so.

Dec. 29th.—6:45 to 8. Clear and quiet; 5th magnitude stars easily seen. Not positive about tail to naked eye; it may be there, but I don't see it. Its cometary nature is more pronounced, however. With p. 25 nucleus strongly condensed, though not positive about it being distinctly stellar. While thinking over it, ran telescope along tail to see how it was coming on. But my stars! how it has grown since last night. Easily and certainly traced to 3½°, and probably nearly 4° long. Looks thin and narrow. Appears to spread sbout 1° from nucleus, and then starts straight and narrow again. A straight, bright streak extends from head nearly to end of tail.

Jan. 2d.—6:40 to 8. Clear; strong wind at times. Moon about 3 days old. With p. 25 don't appear as bright as last time. Tail spreads more, though not as long. Can't trace it more than 1½°. Straight, bright streak seen last time is not visible to-night.

Jan. 3d.—6:45 to 7:30. Very clear, moonlight; some little wind. Decided nebulosity to naked eye now, and upon first looking up think can detect tail, but very short if I do. Through finder nucleus very plain, tail about 1°. With p. 25 tail about 1½° or so; pretty straight, and appears to taper to a point about 1° or so from head.

Jan. 13th.—7:15 to 7:45. Very clear now; cloudy all day. Moon up, but behind clouds. Almost equal to a *Pegasi;* sometimes, with averted vision, suspected as fully equal to it. Looks like a star, with only a small trace of nebulosity. Disappointed about tail, but nucleus is much brighter than expected, and much brighter than when last seen (9th)

With p. 25 a strange change in nucleus or coma since last seen. Never saw it look this way before. A *sharp* and *distinct* stellar point, surrounded by a bright, almost circular nebulosity, and then outside of this the regular faint coma.

(*To be continued.*)

CORRESPONDENCE.

To the Editor of the SIDEREAL MESSENGER:

MY DEAR SIR:—You are doubtless familiar with the verses written by Sir JOHN HERSCHEL to be sung on the occasion of sealing up the 40-foot reflector at Slough, as they have been frequently printed. You may not have seen, however, the Latin translation of them which I enclose. It has been copied for me by my friend Dr. R. GARNETT, superintendent of the reading room of the British Museum, from "Trash from Parnassus," a little pamphlet privately printed in Cambridge, England, in 1842. The translation is signed "F," and Dr. GARNETT supposes this to stand for THOMAS FORSTER, the writer on calendars.

I enclose Sir JOHN HERSCHEL'S original verses (which never seemed to me to be quite worthy of the occasion), and the Latin translation (in which they seem to gain dignity), and I shall be glad if they seem to you worth reproduction. I am, my dear sir,

Very truly yours,

EDWARD S. HOLDEN.

Washburn Observatory, Madison, March 16, 1884.

THE HERSCHELLIAN TELESCOPE SONG.

Requiem of the Forty feet Reflector at Slough, to be sung on the New Year's Eve, 1839–40, by Papa, Mamma, Madame, and all the little Bodies in the tube thereof assembled.

In the old Telescope's tube we sit,
And the shades of the past around us flit;
His requiem sing we with shout and with din,
While the old year goes out and the new one comes in.

(Chorus of youths and virgins.)

Merrily, merrily, let us all sing,
And make the old Telescope rattle and ring.

Full fifty years did he laugh at the storm,
And the blast could not shake his majestic form;
Now prone he lies where he once stood high,
And searched the deep heavens with his broad, bright eye.

Merrily, merrily, etc.

There are wonders no living wight hath seen,
Which within this hollow have pictured been,
Which mortal record can ne'er recall,
And are known to Him only who made them all.

Merrily, merrily, etc.

Here watched our father the wintry night,
And his gaze hath been fed with pre-Adamite light;
While planets above him in circular dance,
Sent down on his toils a propitious glance.

Merrily, merrily, etc.

He has stretched him quietly down at length,
To bask in the starlight his giant strength;
And Time shall here a tough morsel find,
For his steel-devouring teeth to grind.

Merrily, merrily, etc.

He will grind it at last, as grind it he must,
And its brass and its iron shall be clay and dust;
But scathless ages shall roll away
And nurture its frame in its form's decay.

Merrily, merrily, etc.

A new year dawns, and the old year's past,
God send us a happy one, like the last;
A little more sun, and a little less rain,
To save us from cough and rheumatic pain.*

Merrily, merrily, etc.

God grant that its end this group may find
In love and in harmony fondly joined;
And that some of us, fifty years hence, once more
May make the old Telescope's echoes roar.†

(Chorus, fortissimo.)

Merrily, merrily, let us all sing,
And make the old Telescope rattle and ring.

H.

—*1839 was a very wet year.—N. G.

—†*Tuba mirum spargens sonum.*—N. G.

TUBUS HERSCHELLII.

Hic pater et mater filii filiæque sedemus
Ecce telescopii, nocte micante, tubo!
Hic læta insolitos faciamus voce sonores,
Dum novus annus adest, et vetus inde fugit!

Chorus.

Lætus io jam quisque canet, mimicoque canore
Echo per veterum concinet acta tubum!

Horrida qninque annos ridebat flamina cæli;
Tempestas formam rumpere nulla potest,
Ast ubi stelliferum porrexit in ardua truncum
Procumbit gelido machina grandis humo.

Lætus io, etc.

Multa telescopio fulserunt sidera noctu,
Astraque mortali non numeranda manu,
Inque cavo longo quot sunt miracula visa!
Quæ solum omnipotens conspicit ipse Deus.

Lætus io, etc.

Hic mihi per noctem pater observare solebat
Ante hominem facti lumina multa poli,
Dum illi, perpetuis cœlo revolubile gyris,
Mulcebat vultum quisque planeta suum.

Lætus io, etc.

Omnia tempus edax mordaci dente vorabit;
En sub Fortunæ calcibus omne perit!
Et quamvis facile inveniet non dentibus ipsis,
Sera giganteum pulveret Hora tubum.

Lætus io, etc.

In vano hoc faciet; nam facta notata per illum,
Dum vivit Cybele, vera videnda manent:
Iam novus annus adest vetus aura atque annus abibit.
Di mittant pluviæ, sole tepente, minus.

Lætus io, etc.

Tempore venturo Fors protegat omnia vobis,
Eque tubo intactas fundat uterque preces,
Ut placeat Divis multos revoluta per annos
Turba telescopico quæ canet orta choro.

Lætus io, etc.

F.

TUNBRIDGE WELLS, Feb. 25, 1842.

EDITORIAL NOTES.

DOUBLE-STAR OBSERVATIONS.

The double-star observations of S. W. BURNHAM of Chicago, made in 1879 and 1880, with the 18½-inch refractor of the Dearborn observatory, have been recently published in the Memoirs of the Royal Astronomical Society of England. The reprint of this important American work is before us. It consists (1) of 151 new double-stars with measures, (2) of the micrometrical measures of 770 double-stars. In the introduction will be found a full-page map showing the distribution of the stars, a description of Mr. BURNHAM'S mode of observing, a full account of the micrometer used with new method of bright-wire illumination, and remarks concerning the excellent observing-seat devised by Professor G. W. HOUGH. The map and what it shows are presented elsewhere in an extract from the appendix of the catalogue. When it is remembered that the fourteen catalogues of double-stars published by Mr. BURNHAM since 1873 now contain 1013 numbers, chiefly, if not all, new double-stars, something of the magnitude of the work will be understood, and if it be added that his measures are esteemed authority the world over, the publication of them abroad will not be surprising, except that the Royal Astronomical Society should have anticipated American enterprise in this thing.

Nature (Feb. 28) refers to Mr. BURNHAM'S work in the following complimentary way: "Every one who is interested in this branch of astronomical science will read with much regret one remark in Mr. BURNAM'S introduction. He writes: "The present catalogue will conclude my astronomical work—at least so far as any regular or systematic observations are concerned." He expresses himself modestly respecting his own labors: "In a field so infinitely large, one can accomplish but little at the most, and how much or how little, the astronomers of a few centuries hence can, perhaps, best decide. * * * At this time I may venture to claim that my work in this field has been prosecuted with some enthusiasm, and for its own sake only, and that my interest has not been divided among several specialties."

But a higher estimate of Mr. BURNHAM'S work in this particular line of observational astronomy, to which he has devoted himself, may be justly taken. To read the discovery of upwards of a thousand double-stars within a limited period by one observer, we might almost suppose we were living in the days of Sir WILLIAM HERSCHEL, when the heavens were comparatively an open field, and had not undergone the wide and close exploration which they had done when Mr. BURNHAM commenced his work. He has had, it is true, the advantage of

instruments of the finest class, and we may believe, an unusually acute vision; but he must have exercised an extraordinary and most meritorious amount of patience, perseverance and care in the discovery and accurate measurement of such a list of double-stars, and it will be gratifying to the astronomical world that such well-directed exertions have met with so exceptional a success."

In Brooklyn, N. Y., and vicinity, there is an amateur astronomical society. Mr. S. V. WHITE, the broker, of 210 Columbia Heights, Brooklyn, is president, and WILLIAM T. GREGG, of same place, is treasurer. One Washington astronomer seriously doubts whether an amateur society can possibly carry so large a name as the "American Astronomical Society," and says it has no right to if it can.

ALGOL'S MINIMA.

	1883 Nov. 28	Dec. 21	1884 Feb. 2	Feb. 22	March 3	March 16
	h m	h m	h m	h m	h m	h m
SAWYER 75°	7 0*	5 30	5 42	7 23	9 4	5 53
HOOPER 75°			6 30*	8 11	9 52	6 41
PARIS 75°			7 16	8 57	10 39	7 28
IRISH 75°		7 30*	7 44	9 25	11 7	7 55
" 90°		6 30*	6 44	8 25	10 7	6 55

The table above shows some variation in the times of Algol's minima, as taken from several sources. Those marked with a star are times as observed, the others are computed from them. The third line in the table is taken from a Paris periodical which regularly gives the time in advance. All the table is reduced to 75° time except the bottom line which is 90° time and taken from the table of Mr. IRISH in the February MESSENGER. The figures show a difference between Messrs. SAWYER and IRISH, of two hours instead of one as stated by the latter, (Nov. 28 and Dec. 21). On Feb. 2, having the Paris time I went into the observatory at $6^h\ 30^m$ and found the star then about. 3½ mag., and at $7^h\ 10^m$ was above 3d mag., while at 9^h it had reached maximum evidently ahead of the predicted time, both Paris and Irish. Every other date has been cloudy until March 16, when a fairly close observation gives $7^h\ 30^m$ as time of greatest obscuration, very nearly exactly the Paris time, and a little ahead of Mr. Irish. These discrepancies can hardly be a variation of the stars period, but, rather, indicating the difficulty of getting a satisfactory observation except at long intervals. J. R. H.

Bound volumes I, II, of the MESSENGER in neat, plain library style, will be sent to any address, post-paid for $2.75 per volume.

E. L. TROUVELOT observed the Pons-Brook's comet, Dec. 17, 1883, at $6^h\ 3^m$, Marseilles (France) mean time, with a telescope of 156 m m. in aperture and power 85. The following is a copy of his drawing, as in *La Nature:*

THE COMET AT MARSEILLES.

Our readers will be interested to compare this drawing with the one published in the January MESSENGER, which was furnished by Mr. J. R. HOOPER of Baltimore.

Nature (Feb. 14) has the following interesting facts respecting the Pons-Brooks' comet: "This comet approaches the orbit of *Venus* within 0.076 (*Earth's* distance from the *Sun* being 1); that of *Jupiter* within 1.98; and that of *Uranus* within 1.17. The ascending node falls at a distance of 15.46. During the revolution of 1812–1884, the calculations of M. M. SCHULHOF and BOSSERT show that the approximate effect of the planetary attraction upon the periodic time, at the instant of perihelion passage in the former year, has been as follows:

Comet accelerated by action of	*Jupiter*,	446.49 days.
" " " " "	*Saturn*,	13.96 "
Comet retarded by action of	*Uranus*,	13.48 "
" " " " "	*Neptune*,	1.48 "

Hence the period of revolution in 1812 has been shortened by perturbation to the extent of 445.49 days. The orbital velocity of the comet at perihelion is 29.2 miles in a second, at aphelion it is 3550 feet in the same time.

THE OCCULTATION OF BETA CAPRICORNI.

Much the same phenomena, connected with the occultation of the little star preceding *Beta Capricorni*, as were observed by Mr. BARNARD (MESSENGER, December, 1883, page 290), and by Mr. SAWYER (MESSSENGER, January, 1884, page 312), were observed by myself here on the same occasion. I transcribe the following record from my observing-book:—

1883. Nov. 6.3.

Moon 1.40 before first quarter.

Dimensions 7 mag. star same decl. as *Beta Capricorni* and 4′ pr. in R. A.

8 16 2.5 Bl. [Chronometer Bliss 2083] Wt. .4

Star = B. A. C. 6992.
= Yarnall 8811.
= Newcomb (Standard Stars) 900.

"The star disappeared very sharply at the above time, but about 1s.5 later a winged blur of light appeared at the same spot of the *Moon's* limb, and was visible for two or three-tenths of a second, and of about one-half the brightness of the star itself. I have never before observed anything like this. The disappearance took place at about 90° from the north point. Power 90±."

I have nothing to add to the above record, of my own observation, except, perhaps, that the first disappearance of the star was total; and I was about removing my eye from the telescope to verify the beat of the chronometer, when there appeared what I have described as a winged blur of light * * * of about one-half the brightness of the star itself. I add this only because all the circumstances of the observations are still so perfectly recalled in my mind.

It may be worth the while to add, also, that the theory of duplicity of the star will not suffice to account for all these phenomena. They may, however, be in part explained, if the star shall be found to be a double—a matter which can now be very soon determined.

DAVID P. TODD.

Lawrence Observatory, Amherst, Mass.

The large nebula figured by Dr. SWIFT in the SIDEREAL MESSENGER No. 22, p. 57, is indeed a remarkable object; but probably the most wonderful thing about it is that observers should have failed to see it long ago, since it is very noticeable. Amateurs may look this up, as it will be seen with ordinary telescopes. Bring the cluster (mentioned by Dr. S. and a naked eye object) into the field, and just north preceding this scattering cluster will be the nebula, which is larger than the ordinary field. E. E. B.

NEW INVESTIGATIONS ON THE CONSTANTS OF PRECESSION.

In one of the last meetings of the "Niedersheinische Gesellschaft fur Natur & Heilkunde," Dr. SCHOENFELD presented a lately published article by Mr. F. BOLTE, entitled: "Investigations on the Constants of Precession, based upon the Star catalogues of Lalande & Schjellerup." The writer here makes the first attempt to take into consideration the regular proper motion of the fixed stars in the determination of these important constants; while up to this time those parallactic changes of star positions, at most, have been considered which are due to the motion of the solar system. Such legitimate proper motions may be of different kinds, but the most obvious assumption is that they occur in planes which are but slightly inclined to the plane of the Milky Way. This is the idea that the writer has adopted, and he has applied it to the 3300 stars common to the above mentioned catalogues, supplementing a treatise of DOEYER'S, which the latter discusses the R. A's. of these stars, by considering their Declinations at the same time. The result for the precession is a very good substantiation of STRUVE'S constant, now so commonly applied in our almanacs; for the assumed common motion of the stars, however, it is an entirely negative one, for its value, determined as 0".4 per century, is much less than its probable error.

The speaker touched upon various possible explanations of this interesting result, particularly this: That the attraction of the Milky Way upon the individual stars may be counteracted by the attraction of the nebulæ which are most thickly clustered about the poles of the Milky Way.—From *Sirius*, February, 1884.

Professor H. C. WILSON, astronomer, in charge of the Cincinnati observatory, has issued the seventh publication of the observatory, which contains the observations of the comets of 1880, 1881 and 1882, made under the direction of Professor ORMOND STONE, until June, 1882. Since that time the work has been carried forward by himself.

Besides the ordinary observations for positions, interesting physical studies of the comets for the three years named are also presented. The method used in reducing and discussing observations of the trains of comets is that of Professor BREDICHIN, director of the observatory of Moscow. For reduction to the plane of the orbit formulæ found in A. A. Nos. 300 and 1172 were used. This publication also contains ten full-page drawings, showing interesting physical changes in nuclei and tails of *b* 1881, *a* and *c* of 1882. The notes that precede these drawings are instructive, for they indicate how the new physical theories of Professor BREDICHIN stand the test in relation to these comets.

AMATEUR STAR-STUDIES.

To the Editor of the SIDEREAL MESSENGER:

Your articles on "Astronomy in High Schools" must be welcome to a wide circle of readers. Prof. HAGEN has also done amateurs a kindly service by showing them how the calculation of eclipses may be made by students of algebra. May I call attention to another fascinating field of study that is open to them without knowledge of the higher mathematics?

Working out the orbits of double-stars by a graphical method, from the tables of observations, is quite within the reach of most persons who interest themselves at all in astronomical studies. A very slight equipment is required, of which the essentials are: "A Hand-book of Double-Stars," or some other work setting forth a graphical method, and containing records of observations; a broad table; an ellipsograph; a set of drawing instruments (protractor, dividers, ruling-pen, etc.); some large sheets of paper, and a sheet of millimetre paper. The "Hand-book" will be ordered from London (if necessary) by any publishing house. The table should be smooth, and should stand three and a half or four feet high. It should be tested with a level, in the place where it is to be used, and made perfectly horizontal. A good ellipsograph is indispensable. Nothing can be done trying to draw an ellipse with string and pins. A wooden trammel may be constructed after the fashion of the instrument used by cabinet-makers (reduced in size, of course) at trifling expense, or a metal one may be ordered of any dealer in astronomical apparatus. The great objection to both is, that they do not rest firmly upon the paper, or are held in place by brads, which deface the paper by punching holes in it. To obviate this trouble I have had a trammel made by plowing the furrows for the sliding-buttons on the face of a wheel of brass six inches in diameter and one inch and a half thick, filled on the under side with lead for the sake of added weight. This instrument stays in its place without pins. A smaller one of the same construction, about four inches in diameter, will be found convenient at times. Or, what would be better, if one did not stand for cost, the instrument might be made of concentric rings neatly fitting together, and so reducible to any desired size. The rod carrying the drawing-pen should be of steel, about eighteen inches in length. The pen should have a plumb-line attached, that its perpendicularity may be always secured. A sheet of millimetre paper costs 25 cents, and may be ordered of any dealer in engineers' supplies.

Thus equipped, the amateur will have means pleasantly to occupy all his leisure days and nights, when sun and stars do not shine, though he live in the cloudiest corner of the world.

N. M. MANN.

By oversight we have omitted to mention before the late gift of Mr. LEWIS M. RUTHERFORD of New York City to the trustees of Columbia college. The gift consisted of the valuable astronomical instruments of his private observatory on Second avenue, and were as follows: A thirteen-inch equatorial telescope with mounting and clockwork complete; a photographic lens with accessories for celestial photography; two micrometers for measuring double-stars; four micrometers for measuring star-plates, now in use by Dr. B. A. Gould at Washington; a transit instrument by Stackpole & Brother; a sidereal clock and additional appliances for the observatory.

Professor REES, director of the observatory of Columbia college, says the outfit would cost at least $12,000. Mr. RUTHERFORD generously bears the expense of moving and of re-mounting the instruments.

The following table appears in a recent number of *The Artisan* (Nashville, Tenn.), which gives the date of discovery of comets and the names of the persons who have received the Warner prize for the same:

Date.	Discoverer.
1881, May 1,	Lewis Swift.
1881, July 13,	J. M. Schaeberle.
1881, Sept. 17,	E. E. Barnard.
1882, Nov. 16,	Lewis Swift.
1883, Sept. 1,	Wm. R. Brooks.

A special award of $250 was given for the last discovery. The others received $200 each.

Nov. 24, 1883.—Large, bright meteors were frequent on the night of Nov. 23, before midnight. A grand meteor, ¼ full moon, appeared in the west at $6^h\ 42^m$, motion west, quite slow; intensely white; burst into fragments about $19^h\ 30^m$, + 14°. Place of disappearance about $18^h\ 50^m$, + 5°. A friend saw a meteor at about $5^h\ 30^m$, in the east, at an altitude of 30°, traveling to the southwest. It disappeared during its flight, and reappeared to burst with dazzling brilliancy, leaving a train visible for some time. Small meteors were frequent, west of the zenith, with motion westward. A fine one, equaling *Jupiter*, in the east, burst at about $9^h\ 30^m$, shooting vertically downward from an altitude of 25°.

The "Gegenschein" was visible a little south of east of the *Pleiades*, and involving that group, while a zodiacal band stretched from the southwest horizon to the "Gergenschein." This wonderful object, I find, always visible since the first of October, when the moon is absent. It moves eastward as fast as the *Sun*, keeping nearly in opposition.

E. E. B.

OMICRON CETI.

On the evening of February 29th, I found *Mira* quite bright at 7^h 45^m (Nashville mean time). It was brighter than *Alpha Piscium* (B. A. C. 625), or *Delta Ceti* (B. A. C. 811). I judged its brightness to be equal to that of *Eta Eridani* (B. A. C. 910). This would make it about the third magnitude. It was remarkably ruddy—so much so that it at once attracted attention as soon as it entered the field of the instrument, and thereby caused its identification. I was not thinking of *Mira* at the time, and was for several minutes in doubt as to what star it could be, because it was strange to me. There is a small companion south which appeared of an ashy hue, or, possibly, pale blue. WEBB (Celestial Objects) says that in 1878 he found no trace of red in *Mira*. *Alpha* was redder. HERSCHEL describes it as very full ruby.

E. E. BARNARD.

During the month of March subscriptions were received from the following named persons:—

Hon. Gordon E. Cole, Faribanlt, Minn.; J. W. Rall, St. Louis, Mo.; Academy of Sciences, by Wm. Robasz, Rochester, N. Y.; M. A. G. Meads, Buffalo, N. Y.; E. Howard & Co., Boston, Mass.; Thomas P. Peckham, Ledyard, N. Y.; Professor A. L. Brewer, Classical and Military School, San Meteo, Cal.; Mrs. Sarah C. Strong, Beloit, Wis.; Justice Stahn, Baltimore, Md.; Henry H. Parkhurst, New York City; N. Y.; Professor William A. Rogers, Harvard College Observatory, Cambridge, Mass.; Library of the U. S. Naval Observatory, Washington, D. C.; E. Crocker, Berea, Ohio; Frank Smith, Ypsilanti, Mich., Professor Geo. Davidson, U. S. Coast Survey, San Francisco, Cal.; James Bird, Atlanta, Louisiana; James S. Lawson, U. S. Coast and Geodetic Survey, San Francisco, Cal.; Professor E. L. Schaefer, Bethlehem, Pa.; J. J. Gilbert, U. S. Coast and Geodetic Survey, Seabeck Olympia, Washington Territory; F. G. Blenn, (Vols. I, II, III) East Oakland, Cal.; W. A. Savage, Columbus, Ohio; G. D. Hulett, Sodus, N. Y.; I. A. Sanford, Neenah, Wis ; Professor D. F. Higgins, Arcadia College, Wolfville, Canada; Professor James M. De Garmo, Institute, Rhinebech, N. Y.; C. W. Tallman, Batavia, N. Y.

The European astronomers and some in America are trying to find a definition for mean solar time on which all can agree.

Mr. C. BURCKHALTER, Oakland, California, has the hearty thanks of the MESSENGER for personal interest in obtaining new subscribers. His recent sketches of *Jupiter* agree well with those of other observers. The photographs of his $10\frac{1}{2}$-inch BRASHEAR reflector, certainly indicate good facilities for observation. He is greatly pleased with the instrument.

XUM

The important discussion "On the deflection of the Level, due to solar and lunar attraction," by Professor J. HAGEN, Sacred Heart College, Prarie du Chien, Wis., appears in this issue. The simple and direct manner in which it is treated makes the mathematical part of it as interesting as the historical.

Current memoranda of the planets and book-notices are deferred for want of space.

From a late issue of *Science* we learn of Astronomical work now going on at Natal. an English colony in South Africa, under the direction of Mr. EDMUND NEISON, government astronomer of that place. The following subjects are being pursued:

1. "The dimension of the exact amount of parllactic inequality of the motion of the *Moon* by means of observations of the positions of of a crater near the center of the lunar surface.
2. The determination of the exact diamater of the *Moon* by observations of pairs of points near the limb.
3. The effect of irradiation and its variations on the apparent semi-diameter of the *Moon*.
4. The systematic variation of the apparent place produced by the irregularities on its limb.
5. The real libration of the *Moon* by a method independent of the errors caused by abnormal variations in the apparent semi-diameter of the *Moon*."

Mr. NEISON'S work entitled "The *Moon* and condition and configuration of its surface," published in 1876, by Longmans, Green & Co,. London, is good authority.

A NEW AND FAINT NEBULOSITY.

I have found in

A. R. $5^h\ 56^m\ 30^s$
Decl. $+10°\ 26\frac{1}{4}'$ } 1884.0.

a very faint nebulosity. It lies a little over $\frac{3}{4}°$ north of *Mu Orionis*, and requires a low power to be seen at all. With my 5-inch refractor and a power of about 30 diameters, it is quite distinct; but higher powers diffuse it greatly. There is a faint star in its center, and several others on its borders, about 2′ diameter. I have repeatedly seen this nebula since January, 1883. E. E. BARNARD.

The Glasgow catalogue of stars, which for some time has been in preparation by Professor GRANT, has been recently published.

MR. TYDEMAN, 835 Linden street, Camden, N. J., has a 3-inch Achromatic; also a 7-inch and a 13½-inch Reflecting Telescope, for sale.

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Term Examinations, March 19th and 20th.
Heywood Prize Contest, March 19th.
Spring Term begins Wednesday, April 2d and ends June 19th.
Examinations to enter the Collegiate Department, June 13th and 14th, and September 2d.
Term Examinations, June 17th and 18th.
Anniversary Exercises, June 16th-19th.
Fall Term begins Wednesday, Sept. 3d.

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Professor Rowland of the Johns Hopkins University has placed in my hands the distribution of the fine gratings ruled on his engine. The plates are ruled with 14,438 lines to the inch. Five sizes are ruled, viz. 1 inch 1½ in, 2 in, 3 in, and 5 in. For full information address, J. A. BRASHEAR, PITTSBURG, S. S. PENNA.

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